Title:
Spotted Wing Drosophila (SWD), *Drosophila suzukii*, infestation risk to tomatoes

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Abstract:
Spotted Wing Drosophila (SWD), *Drosophila suzukii*, an invasive fruit fly from Japan, appeared in NY in 2011 and has become of major concern to small fruit growers. Unlike other fruit flies, it lays eggs in intact fruit prior to harvest. Current pesticide control measures target the adult but there is great risk of developing resistance; resistance has already been reported on the West Coast. Known hosts of SWD include soft skinned fruit like raspberries and blueberries. Even though the wild host range of SWD includes nightshades (*Solanum spp*.) no research had been conducted to evaluate the threat of SWD to tomatoes, *Solanum lycopersicum*.

In 2013 ten varieties of tomatoes were planted to assess if SWD would lay and develop on these varieties in a no-choice test and on field-collected tomatoes. The skin firmness of these varieties was tested and compared to skin firmness of known hosts. Due to the loss of the majority of tomato plants to late blight, only skin firmness for nine varieties was calculated. The oviposition and emergence rates for both the no-choice and field collected tomatoes was not determined due to the loss of the tomato plants to late blight.

Background and justification:
The USDA Annual Vegetable Summary of 2012 showed that over 2,900 acres of fresh market tomatoes were planted in NY in 2012. This was a slight decrease from 2010 but an overall increase of over 7% since 2009 and was valued at nearly $47 million. The sudden arrival of Spotted Wing Drosophila in NY in 2011 caused small fruit growers much concern and compelled this research into whether tomatoes might serve as a host to SWD. With the great variation in tomato varieties it is possible that thinner-skinned tomatoes are at risk. This research will provide a better understanding of which varieties are at risk from SWD thereby decreasing insecticide applications to lower risk varieties. This also addressed one of the priorities listed by the SWD IPM working group: determining damage to different crops.

Objectives:
1. Plant 10 varieties of tomatoes in the organic plot of Gates Farm at the New York State Agricultural Experiment Station in Geneva, NY.
2. Monitor for SWD in tomato plot and hedgerow.
3. Using a TA.XT Plus analyzer determine the skin firmness of the tomato varieties as well as known hosts.
4. Collect SWD emergence data from the ten tomato varieties grown in the field.

5. Conduct no choice tests on the ten tomato varieties collected from the field and introduced into rearing cups containing male and female SWD. Collect emergence data from the no-choice tests.

Procedures:

1. Ten tomato varieties were started on 5/14/13 in the greenhouse and transplanted to the NYSAES's Gates Road organic plot on 6/19/13. Each tomato variety was spaced 18 inches apart in a randomized complete block design consisting of three replicates. Tomato plants were sprayed on a 7-day interval with Cueva at a rate of 34ml/gallon to prevent late blight. This was initiated after the first reported case of late blight in the region on 8/21/13.
2. To monitor for the presence of SWD, one apple cider vinegar trap was placed in the tomato plot as well as one along the adjacent hedgerow and monitored weekly for SWD from 8/5/13 to 9/27/13.
3. Tomato fruit was collected for nine of the 10 varieties as they ripened throughout the growing season. A TA.XT plus texture analyzer was used to evaluate the skin firmness of the different varieties as well as the skin firmness of the known hosts, blueberry, raspberry, strawberry, and grape.
4. No emergence data was collected from field grown tomatoes due to the detection of late blight on 9/7/13. After detection over 50% of plants were pruned out in an attempt to control late blight. In addition the rate of Cueva was increased to the full label rate of 68ml/gallon. However, available fruit was too low to conduct emergence tests. All ripe fruit was used to determine skin firmness.
5. No-choice tests were not conducted due to loss of substantial tomato fruit/plants to late blight.

Results and discussion:

SWD was first detected with the use of apple cider vinegar traps on 8/28/13 in both the tomato plot and the hedgerow (Table 1). Numbers remained low in the tomato plot but began increasing in the hedgerow by the end of September.

Table 1. Total SWD trapped in apple cider vinegar traps in hedgerow and tomato plot.

Date	Hedgerow	Tomato Plot
8/12/13	0	0
8/20/13	0	0
8/28/13	2	1
9/5/13	16	0

9/20/13	102	2
9/27/13	44	3

Tomato fruit from 8 varieties were collected on 8/31/13 and tested for skin firmness using the TA.XT plus (Figure 1). Additional fruit was collected, as it ripened, on 9/6/13 and 9/13/13 from nine of the ten varieties. The variety *Purple Russian* was destroyed by late blight prior to ripening and therefore no fruit was collected and tested for skin firmness. Fruit from blueberries, strawberries, raspberries and grapes were also tested for skin firmness and compared to that of the tomato varieties (Figure 2).

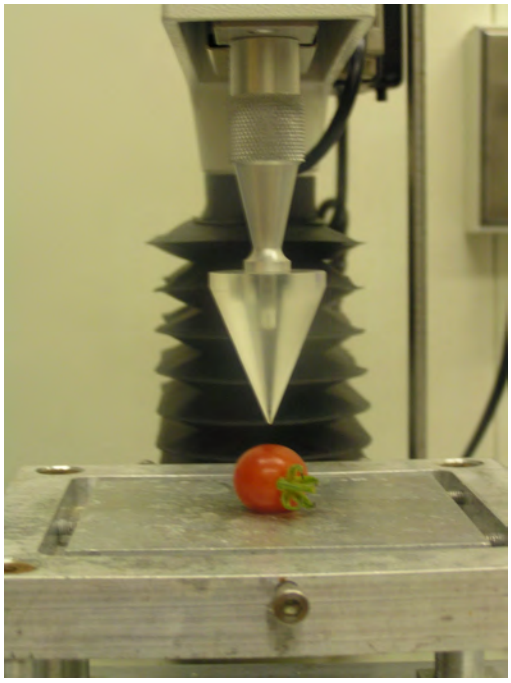

Figure 1. The variety *Matt's wild cherry* on TA.XT plus prior to skin firmness test.

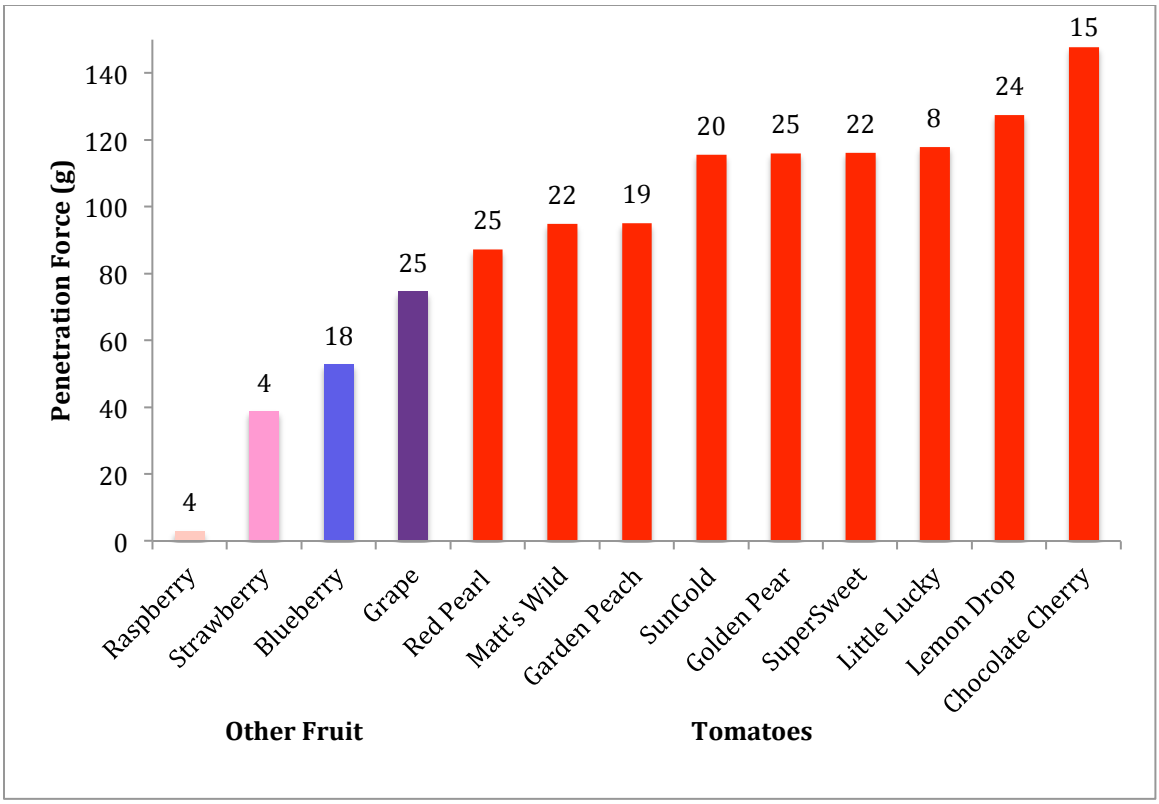

Figure 2. Average force needed to penetrate the skin of nine different tomato varieties and 4 different fruits. Number above the bars represents total fruit sampled.

The results from the skin firmness test show that all nine varieties had a greater penetration force (skin firmness) as compared to the known hosts. The penetration force for tomato fruit ranged from an average 87g in *Red Pearl* to 147g in *Chocolate Cherry*. The single lowest penetration force measured in a tomato came from *Matt's Wild Cherry* and was 52g. This is well within the range of the known host blueberry that averaged 52 g penetration force but had a range of 25g to 106g.

The results from this year will be used in selecting tomato varieties to test in 2014. In addition to the varieties tested in 2013 five additional heirloom varieties that are considered marketable when cracked will be tested for SWD emergence in 2014.

The tomato plot in 2014 will not be located on the organic plot at Gates farm, which will allow for the use of fungicides such as Ridomil to control late blight. This will insure that enough tomato fruit is available for both the no-choice and field emergence tests. Additionally more known hosts, including wild hosts, will be collected and tested for skin firmness.